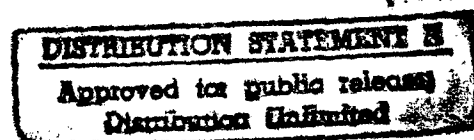
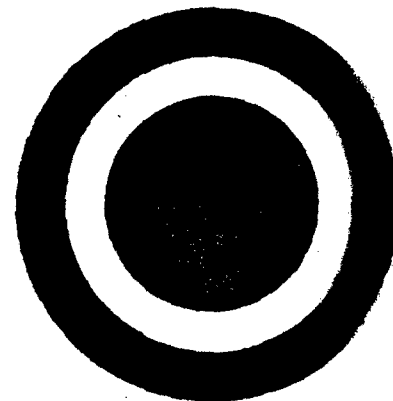


PREFINAL REPORT-AUGUST 1986
VOLUME 1-Executive Summary



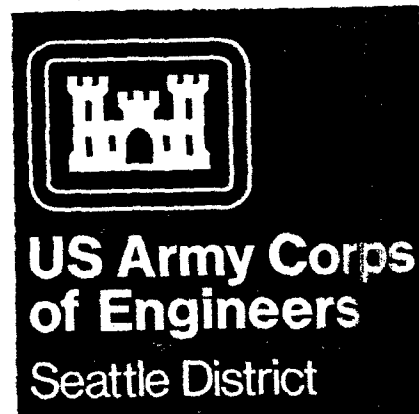
FORT LEWIS
ENERGY SAVINGS
OPPORTUNITY SURVEY

19971021 303

ENERGY ENGINEERING
ANALYSIS PROGRAM
(EEAP)
AT
FT. LEWIS, WASHINGTON
(A FORSCOM INSTALLATION)

DACA67-84-C-0064

DTIC QUALITY INSPECTED 2



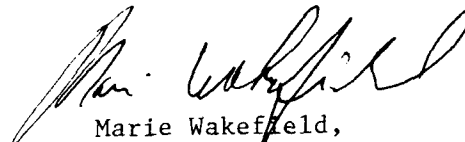


DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
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FORT LEWIS ESOS
PREFINAL REPORT
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1.0 EXECUTIVE SUMMARY

1.1 PURPOSE OF THE STUDY:

The purpose of this study has been to examine potential new energy conservation opportunities (ECO), as well as re-evaluate certain ECO previously studied on a comprehensive basis. Selected special studies have also been undertaken. The end product of this project will result in four (4) applications to the Federal "Energy Conservation Investment Program" (ECIP) for funding of energy improvements. Further, it is assumed that other energy conservation applications, on an annual basis, will be forthcoming in the future to further implement the Fort Lewis Energy Program.

1.2 HISTORY/CONTEXT:

A Base Wide Energy Plan was commenced by the John Graham Co. in 1978 at Fort Lewis, Yakima Firing Center, Vancouver Barracks and Camp Bonneville, reaching substantial completion in 1981. Several special studies, such as a Basewide Energy Monitoring and Control System study (EMCS) were submitted, as late as, 1983. The Base Wide Energy Plan is broad and comprehensive, looking at larger energy issues with several, more detailed concerns addressed. The Plan was the basis for approximately eight ECIP projects, of which half have been submitted for funding consideration by Fort Lewis.

1.3 RELATIONSHIP TO OTHER PLANS/PROJECTS:

The Fort Lewis Base Wide Energy Plan was considered as the basic overall document, from which specific, more detailed studies and implementation projects could be evolved. The plan to date, has been the basis for the Corps of Engineers, Project PN470 and a project by Associated Engineers. Both projects entailed 3 to 6 specific energy improvements, such as insulation, weather stripping, boiler controls, thermostats, and high bay fans for redistribution of warm air. Second, DEH, in its program of facilities upgrading, has instituted compliance to Washington State Energy Code Requirements. In the course of the Limited Building Survey most of this activity has appeared to be centered at the North Fort Lewis Enclave. Other cases of weatherstripping of entry doors have been observed over the larger Fort Lewis Area.

1.4 PRIMARY STUDY
ELEMENTS:

2

This Energy Savings Opportunity Survey (ESOS) comprehensively inventories, analyzes, evaluates, and makes recommendations from a list of 43 energy conservation opportunities (ECO) on a representative group of 91 buildings that represent a larger building population (1,400 buildings) at Fort Lewis. Family housing has been excluded from the study, having been covered under previous studies. In addition, four special areas of interest are being studied. The main blocks of this study are comprised of:

1. A limited building survey of 91 representative buildings, and extending the limited building survey results to approximately 1400 other buildings on the Post.
2. Re-evaluate two previously prepared, but unsubmitted ECIP projects.
3. Evaluate consolidation of Central Distribution Plants #9 and #10 to improve plant efficiency.
4. Re-evaluation of an Energy Monitoring & Control System (EMCS) for North Fort and the Logistics Center.
5. Evaluate the feasibility of limited hydropower at the Central Sewage Treatment Plant System site.
6. Preparation of 4 Project Development Brochures (PDB) for specific energy improvements for consideration of funding by ECIP.

1.5 STUDY AREAS/
LOCATION:

The study area for the Fort Lewis ESOS Study includes the Logistics Center, Main Fort, and North Fort areas, exclusive of family housing. The total study area comprises approximately 4600 acres, of which Main Fort is 2600 acres; Logistics Center, 700 acres; and North Fort, 1300 acres. There are 4,930 buildings and various types of structures on the Fort. Of this total, approximately 2090 buildings are used for family housing, 1400 buildings of various uses with full active occupancy, and about 1440 structures of various types that are not heated or heated so infrequently as not to be a factor for energy consumption. Excluded also are buildings with more or less full use as mess halls. DEH has begun a special energy analysis in the future on this building type, which are primarily located in North Fort.

For purposes of conducting the limited building survey and analysis/evaluation, the Fort was divided into three zones. These zones are characterized by distinct boundaries, such as Interstate 5, or separated by large areas of open space. In addition, the three zones have markedly different construction or use. See the Limited Building Survey Map on page 4 for the locations.

ZONE I is located at Main Fort, being characterized by large buildings constructed of brick, concrete, and steel. Type I permanent construction is common with a significant number having been constructed in the 1930's and 1940's. Buildings surrounding Gray Army Air Field appear to have been constructed between 1950 and 1970. Roughly 20% of the buildings in this zone are wood construction with some being listed as Temporary (T).

ZONE II is located at the Logistics Center, east of Main Fort. The dominant building type in the area are large warehouse structures between 100,000 and 250,000 square feet, with representations of concrete and heavy timber construction. Support buildings, a minority type, are dominantly W W II wood construction with several concrete buildings such as the ADP Building.

ZONE III is located at North Fort in the main troop enclave and is comprised mostly of W W II light wood frame buildings of small size. With the exception of some improved buildings, the structures have few energy improvements.

1.6 SUMMARY OF SIGNIFICANT FINDINGS:

1.61 LIMITED BUILDING SURVEY, ECIP PROJECTS SELECTED:

Using the detailed chart of applicable ECOs (section 2.4) DEH selected the following four ECIP Packages (Appendices A, B, C, and D contain the complete Project Development Brochures):

ECIP

<u>PN</u>	<u>FY90 COST (THOUSANDS)</u>	<u>SQ.FT. (THOUSANDS)</u>	<u>ENERGY SAVINGS (MILLIONS)</u>	<u>DOLLAR SAVINGS (THOUSANDS)</u>	<u>SIMPLE PAYBACK (YEARS)</u>	<u>S.I.R.</u>	<u>ANALYSIS DATE</u>
704	3506	3931.08	131708.77	854.410	3.1	5.7	12/19/85
	(ECO 1A, 16)						
705	3952	4983.46	101112.91	676.720	4.7	3.8	12/19/85
	(ECO 1B)						
706	4480	6498.54	173046.54	1060.070	3.2	5.7	12/19/85
	(ECO 1C)						
707	2748	13511.68	80670.49	563.304	3.7	4.6	12/19/86
	(ECO 3, 4, 42)						

1.62 RE-EVALUATION OF EXISTING PROJECTS (GRAHAM):

There was insufficient data available to evaluate ECIP Projects T-566 and T-567. In addition, should these projects be funded, there would be insufficient information to develop bidding documents or for a contractor to implement the project. It is recommended that new ECIP Projects for similar improvements be developed with new, complete information. Refer to the Interim Submittal for complete discussion of this element.

1.63 CONSOLIDATION OF
CENTRAL DISTRIBUTION PLANTS 9/10
TO IMPROVE PLANT
EFFICIENCY:

This analysis indicates that intertieing Heating Plants #9 and #10 would result in a simple payback, using fuel savings only, or greater than 120 years. If maintenance and operation savings are counted, then the simple payback may be reduced to between 10 and 20 years. Planned construction of a small solid waste incinerator and waste heat boiler adjacent to Plant #9 would adversely impact this intertie if it contributes heat to the Plant #9 distribution system during low load periods. We recommend not proceeding with this intertie for ECIP funding. Refer to the Interim Submittal for complete discussion of this element.

not done in ECAP Program

1.64 RE-EVALUATION OF
THE FEASIBILITY OF
EMCS APPLICATIONS

North Fort Lewis: The application of an EMCS to control buildings which are unoccupied for long periods of time appears to be an attractive option with simple payback in the one year range. A modified load control area network EMCS was estimated as the most cost effective system. The system is based on 22 centrally located load control panels (LCP). Each LCP will control approximately 18 buildings via communication cable on telephone poles (requested as comment to Interim Submittal and included as Appendix I) connected to low voltage override thermostats in the buildings. A central micro computer would communicate with (call-up) the LCPs and initiate reset schedules via non-dedicated telephone lines.

Logistics Center: Due to the presence of digital setback thermostats and regular occupancy of these buildings, there does not appear to be an application for a central EMCS system in this area.

1.65 LIMITED HYDROPOWER
FEASIBILITY
EVALUATION:

The construction of a small hydroelectric facility on the sewage treatment plant outfall appeared to be a feasible option from Energy Savings only. The simple payback for this is about 14 years. This project became unfeasible due to legal and regulatory uncertainties. Refer to Interim Submittal for complete discussion.

1.66 BOILER SURVEY
RESULTS:

The boiler plants surveyed revealed the following energy conservation opportunities:

Insulation of pipes, valves, boiler surfaces, tanks, and condensate receivers.

Burner replacement with more efficient oil-gas combination burners.

Regular preventive maintenance by boiler controls professionals.

Rebuilding and refurbishing oxygen trim controls as required.

5
Under Contract MOD 2 (Appendix I), additional "in-depth" studies of the boiler oxygen trim controls and boiler reset (on outdoor air temperatures) were performed. The small boilers show very poor paybacks due to the high cost of commercially available oxygen monitors. The outdoor reset control looks more promising for small hot water boilers, depending on the existing boiler control system and temperature setpoint.

1.7 SUMMARY OF CONTRACT
MODIFICATIONS:

The following modifications were made to the base contract:

MOD 1 - Schedule revision.

MOD 2 - In-depth building studies - See Appendix I for results.

MOD 3 - Schedule revision.

MOD 4 - Computer generated chart - See Appendix I for results.

2.0 LIMITED BUILDING SURVEY:

2.1 SURVEY PROCESS:

BC&S personnel conducted the Limited Building Survey on 91 buildings during October, November, and December, 1984 at Fort Lewis. The survey was conducted on a zone by zone basis, so the team members could gain solid familiarity with the survey zone, as well as the individual buildings. Each zone was further broken down into survey units, which was defined as the number of buildings that a 1-2 person team could survey in one day. Each 2 person team contained a senior professional; however, in the instance of complex buildings, two senior professionals were employed. Of the 91 buildings surveyed, 8 buildings were specially designated for investigation of boilers only. A senior engineer with special experience in boilers performed this work, in addition to the evaluation of Central Distribution Plants #9 and #10. A comprehensive list of 43 Energy Conservation Opportunities (ECO) developed by the Corps of Engineers (CE) formed the basis of the investigations. In some instances, all 43 ECO were investigated, while in other instances, fewer were studied at Seattle District Corps of Engineers' direction due to special characteristics of the buildings.

2.2 EXISTING CONDITIONS SUMMARY:

Fort Lewis should be considered more or less fully developed, unless a dramatic change were to occur in its mission. The general average age of the structures is in the area of 30 years old. The fort, as a whole, is well maintained, considering the age of the buildings.

2.3 MAINTENANCE ITEMS SUBMITTED TO FORT LEWIS:

Per agreement with DEH, Fort Lewis at the exit interview, BC&S forwarded a list of maintenance items for DEH action, which were contained in the ~~Interim Report Appendix~~, Section G. Most items contained in this list are minor in nature, with the exception of a defective rotating screen filter for the waste water heat recovery system at the Post Laundry. This item caused a significant energy use, which has since been repaired. There are some areas at Fort Lewis where maintenance and operations (M & O) is not clear and responsibilities appear to overlap. Single point responsibility for all M & O activity at the Fort would be desirable and should be considered. An active preventive maintenance program would result in considerable energy and mechanical and operations cost savings.

2.4 CHARTS OF APPLICABLE ECO:

The ECO determined to be applicable were subjected to engineering analysis and Life Cycle Cost Studies performed per TM5-800-3, AR415-15, and associated ECIP guidance provided by the government. These ECO are listed in the following table by Savings-to-Investment Ratio (SIR):

ECO #	DESCRIPTION	# BLDGS.	(THOUSANDS)		SIR
			TOTAL	SQUARE FT.	
22	Install low GPM showerheads	360	4462.29		108.5
17	Night setback/set up thermostats	428	4771.96		67.3
11	Reduce light level	64	456.17		39.4
46	Insulate Domestic Hot Water pipes	548	2636.96		29.8
32	Insulate condensate lines	3	41.38		20.7
25	Prevent air stratification	95	1004.37		13.8
48	Insulate supply ducts	388	1086.03		12.7
3 *	Weatherstripping and caulking	1177	6519.86		10.9
1A *	Insulate floors	863	3232.03		9.0
44	Pool covers	3	N/A		8.1
1C *	Insulate roofs	1200	6498.54		5.7
47	Insulate Domestic Hot Water tanks	224	2776.20		4.2
26	Install electronic timing devices	15	436.91		3.8
1B *	Insulate walls	1036	4983.46		3.8
12	Replace incandescent lighting	659	6061.75		3.8
4 *	Insulate panels	22	1579.44		2.8
20	Radiator controls	37	388.87		2.4
16 *	Radiant heat (Natural Gas)	72	699.05		1.6
2	Install storm windows	1014	5390.72		1.4
41	Heat pumps	796	3734.56		1.3
42 *	Instantaneous Hot Water Heaters	871	5412.38		1.2
28	Revise boiler controls	81	1173.13		1.01
19	Control Hot Water Circulation Pump	79	2311.60		.75
13	Use more efficient lighting source & light sensors	84	1477.39		.21
9	Shutdown energy to hot water heaters or modify controls			(Payback beyond acceptable range S.I.R. not calculated)	

* Selected by DEH for ECIP Application.

2.4 (cont'd):

As a result of the Interim Submittal Review Conference, charts were prepared containing complete summary information for each ECO. These charts follow:

B20 - 10 FLOOR INCL.	C1 BUILDINGS				C1 BUILDING VARIABLES				C2 BUILDINGS				C1 AND C2 BUILDING TOTAL VARIABLES				
	BLDG #	BLDG AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	# OF BLDG	BLDG AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	SAVE/INVEST RATIO			
	1R2	4.81	2.3	238.00	3.675	1.620	6	22.28	27.19	2.3	1317.97	20.350	8.971				
	2R17	8.19	2.4	180.00	3.080	1.208	322	621.13	629.32	2.4	13831.21	236.730	92.822				
	3R35	14.65	3.0	546.00	10.990	3.720	2	26.72	41.38	3.0	1542.21	31.033	10.504				
	6R10	4.70	1.6	164.00	1.770	1.118	-	-	4.70	1.6	164.00	1.770	1.118				
	6R32	4.70	1.6	164.00	1.770	1.118	231	1036.80	1041.50	1.6	36341.70	392.224	247.700				
	5B8	4.70	1.6	164.00	1.770	1.118	-	-	4.70	1.6	164.00	1.770	1.118				
	5B31	4.70	1.6	164.00	1.770	1.118	-	-	4.70	1.6	164.00	1.770	1.118				
	5B32	4.70	1.6	164.00	1.770	1.118	-	-	4.70	1.6	164.00	1.770	1.118				
	10B8	14.65	2.4	463.00	7.625	3.154	12	31.06	45.71	2.4	1444.62	23.795	9.843				
	1E4	4.72	1.6	164.00	1.770	1.118	-	-	4.72	1.6	164.00	1.770	1.118				
	1E6	4.72	2.5	103.00	1.770	.702	182	724.50	729.22	2.5	15913.06	273.450	109.574				
	1E20	7.67	1.6	270.00	2.876	1.815	-	-	7.67	1.6	270.00	2.876	1.815				
	2E4	2.28	2.5	99.50	1.713	.680	-	-	2.28	2.5	99.50	1.713	.680				
	3E34	3.78	2.0	206.00	2.834	1.407	8	39.82	43.80	2.0	2376.08	32.699	16.234				
	F2	9.83	2.4	448.00	7.380	3.053	62	309.41	319.24	2.4	14549.29	239.647	99.138				
	1J6	2.00	2.4	89.90	1.500	.613	6	37.99	39.99	2.4	1797.55	29.982	12.257				
	1033	11.89	6.3	250.00	8.990	1.700	10	70.70	82.69	6.3	1724.14	62.011	11.726				
	2270	3.72	3.1	132.00	2.786	.900	5	19.99	23.70	3.1	840.96	17.774	5.742				
	2409	7.67	2.5	167.00	2.876	1.140	4	25.23	32.90	2.5	716.34	12.337	4.890				
	5038	13.32	1.6	926.00	9.988	6.308	12	120.63	133.94	1.6	9311.44	100.459	63.446				
	5209	8.18	1.6	568.00	6.134	3.870	-	-	8.18	1.6	568.00	6.134	3.870				
	TOTAL	146.78	2.2	5670.40	84.817	38.598	842	3086.26	3232.03	2.1	103464.07	1492.074	704.802	9.0			

C1 BUILDINGS		C1 BUILDING VARIABLES				C2 BUILDINGS		C1 AND C2 BUILDING TOTAL VARIABLES					
BLOO #	BLOO AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (KWH 810/HR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	# OF BLOO	BLOO AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (KWH 810/HR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	SAVE/INVEST RATIO
1A2	4.81	4.1	75.10	2.116	-5.11	6	22.28	27.19	4.1	415.60	11.710	2.828	
1A24	8.00	2.8	168.00	3.266	1.148	29	202.61	210.61	2.8	4517.81	87.808	30.863	
2A17	8.19	4.6	170.00	5.325	1.150	322	621.13	629.32	4.6	13154.50	411.999	89.759	
3A2	11.19	4.2	82.60	2.375	-5.82	1	11.71	22.89	4.2	169.05	4.861	1.150	
3A10	22.33	5.2	110.00	3.770	.720	-	-	22.33	5.2	110.00	3.770	.720	
3A35	14.65	6.0	123.00	5.070	.840	2	26.72	41.38	6.0	347.32	14.316	2.372	
6A10	4.70	2.8	117.00	2.267	.797	-	-	4.70	2.8	117.00	2.267	.797	
6A32	4.70	2.8	117.00	2.267	.797	231	1036.80	1041.50	2.8	25915.50	502.358	176.600	
1B16	3.11	4.3	49.00	1.444	-3.34	-	-	3.11	4.3	49.00	1.444	-3.34	
5B8	4.70	2.8	117.00	2.267	.797	-	-	4.70	2.8	117.00	2.267	.797	
5B31	4.70	2.8	117.00	2.267	.797	-	-	4.70	2.8	117.00	2.267	.797	
5B32	4.70	2.8	117.00	2.267	.797	-	-	4.70	2.8	117.00	2.267	.797	
10B8	14.65	4.3	241.00	7.125	1.642	12	31.06	45.71	4.3	752.08	22.235	5.124	
1C14	3.11	4.4	58.20	1.734	.397	11	99.46	102.57	4.4	1920.75	57.226	13.102	
1E4	4.72	2.8	89.00	1.730	-6.08	-	-	4.72	2.8	89.00	1.730	-6.08	
1E6	4.72	4.6	56.00	1.730	.360	162	724.50	729.22	4.5	9766.71	269.545	59.505	
1E20	7.67	2.9	95.00	1.826	.640	-	-	7.67	2.9	95.00	1.826	.640	
2E4	2.28	4.5	98.00	3.024	-6.68	-	-	2.28	4.5	98.00	3.024	-6.68	
3E34	3.76	3.6	89.00	2.200	.608	8	39.82	43.60	3.6	1026.90	29.364	7.015	
F2	9.83	4.3	81.50	2.411	.555	62	309.41	319.24	4.3	2646.51	78.291	18.022	
1J5	2.00	4.4	42.20	1.264	-2.87	6	37.99	39.99	4.4	843.77	25.273	5.738	
4A31	4.72	4.5	25.00	.781	.175	31	159.03	163.75	4.5	867.29	27.094	6.071	
1033	11.99	3.7	146.00	3.710	.993	10	70.70	82.69	3.7	1007.07	25.591	6.849	
1263	34.73	6.9	240.70	11.258	1.640	-	-	34.73	6.9	240.70	11.258	1.640	
2022	37.99	2.9	650.00	12.759	4.420	-	-	37.99	2.9	650.00	12.759	4.420	
2050	5.85	1.8	422.00	5.274	2.877	3	24.66	30.51	1.8	2202.25	27.523	15.014	
2270	3.72	-9	294.00	1.896	2.009	5	19.99	23.70	-9	1875.66	12.096	12.817	
2409	7.67	4.6	85.00	2.562	.580	4	25.23	32.90	4.6	364.62	11.419	2.488	
3041	20.97	20.1	56.00	5.185	.258	-	-	20.97	20.1	56.00	5.185	.258	
3170	3.17	17.4	186.00	15.720	.902	-	-	3.17	17.4	186.00	15.720	.902	
3204	12.44	13.6	455.00	29.950	2.206	8	32.63	45.07	13.6	1648.48	108.510	7.992	
3271	10.00	57.0	66.00	18.240	.320	2	18.53	28.53	57.0	186.28	52.033	.912	
3277	2.58	14.2	150.00	10.330	.727	33	224.77	227.34	14.2	13227.90	910.963	64.060	
3470	60.77	1.7	1290.00	10.483	6.256	6	355.08	405.85	1.7	11602.48	94.286	50.009	
3653	50.77	1.9	1290.00	10.483	5.705	-	-	50.77	1.9	1290.00	10.483	5.705	
4060	18.24	7.1	102.00	4.561	.696	22	123.79	142.03	7.1	734.25	38.630	5.420	
4076	22.12	5.3	208.00	7.553	1.420	7	72.04	94.16	5.3	885.35	32.149	6.044	
4290	74.36	2.3	540.00	8.539	3.680	1	14.57	89.32	2.3	648.72	10.258	4.433	
5102	15.73	3.2	101.00	1.920	.605	-	-	15.73	3.2	101.00	1.920	.605	
5038	13.32	2.9	177.00	3.480	1.204	12	120.63	133.94	2.9	1780.26	35.002	12.110	
5208	8.18	2.9	107.00	2.119	.735	-	-	8.18	2.9	107.00	2.119	.735	
TOTAL	567.95	4.3	9806.30	225.048	52.463	996	4425.54	4983.46	4.7	101112.91	2875.866	626.720	3.8

C1 BUILDING VARIABLES														C2 BUILDINGS				C1 AND C2 BUILDING TOTAL VARIABLES					
BLDG #	BLDG AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	OF BLDG	BLDG AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO										
1R2	4.91	4-1	139-00	3-900	-946	6	22-28	27-19	4-1	769-22	21-583	5-235											
1R24	8-00	2-9	155-00	3-048	1-059	29	202-61	210-61	2-9	4230-57	83-242	28-879											
2R17	8-19	4-6	104-00	3-264	-711	322	621-13	629-32	4-6	8047-50	252-540	56-015											
3R2	11-19	4-2	288-00	8-612	2-031	1	11-71	22-69	4-2	609-91	17-626	4-157											
3R35	14-65	3-6	508-00	12-637	3-465	2	26-72	41-38	3-6	1434-45	35-683	9-784											
6R10	4-70	2-9	93-00	1-823	-633	-	-	4-70	2-9	93-00	1-823	-633											
6R32	4-70	2-8	93-00	1-823	-633	231	1036-80	1041-50	2-9	20579-60	403-969	140-300											
1R16	3-11	5-9	67-00	2-682	-457	-	-	3-11	5-9	67-00	2-682	-457											
5R8	4-70	2-9	93-00	1-823	-633	-	-	4-70	2-9	93-00	1-823	-633											
5R31	4-70	2-9	93-00	1-823	-633	-	-	4-70	2-9	93-00	1-823	-633											
5R32	4-70	2-9	93-00	1-823	-633	-	-	4-70	2-9	93-00	1-823	-633											
10R8	14-65	4-4	264-00	7-895	1-796	12	31-06	45-71	4-4	823-85	24-638	5-605											
1C14	3-11	5-9	81-50	3-276	-555	11	99-46	102-57	5-9	2689-71	108-115	18-316											
1E4	4-72	2-9	94-80	1-860	-646	-	-	4-72	2-9	94-80	1-860	-646											
1E6	4-72	4-7	59-59	1-860	-400	162	724-50	729-22	4-6	9298-96	289-185	62-431											
1E20	7-67	3-0	150-00	3-000	1-000	-	-	7-67	3-0	150-00	3-000	1-000											
2E4	2-28	4-5	60-00	1-856	-408	-	-	2-28	4-5	60-00	1-856	-408											
3E34	3-78	4-9	122-00	4-050	-829	8	39-82	43-60	4-9	1407-66	46-730	9-565											
F2	9-83	5-9	255-00	10-168	1-735	62	309-41	319-24	5-9	8280-48	330-180	56-340											
1J6	2-00	4-4	54-40	1-650	-371	6	37-99	39-99	4-4	1087-70	32-991	7-418											
4431	4-72	4-6	59-00	1-860	-400	31	159-03	163-75	4-6	2046-87	64-528	13-877											
1010	20-10	4-8	240-00	7-952	1-632	12	121-91	142-01	4-9	1695-63	56-182	11-500											
1020	16-74	2-9	716-00	14-060	4-882	3	59-79	78-53	2-9	3000-28	58-916	20-457											
1033	11-99	-3	527-00	1-030	3-590	10	70-70	82-69	-3	3635-10	7-105	24-763											
1212	10-16	2-9	450-00	8-767	3-046	22	207-71	217-87	2-9	9645-91	187-924	66-271											
1263	34-73	1-8	2835-00	34-726	19-325	-	-	34-73	1-8	2835-00	34-726	19-325											
1450	33-18	4-5	250-00	7-650	1-700	2	3-98	37-16	4-5	279-98	8-568	1-904											
2006	46-61	7-9	190-00	10-050	1-270	15	293-66	340-27	7-9	1387-04	73-367	9-271											
2022	37-99	2-3	910-00	14-553	6-200	-	-	37-99	2-3	910-00	14-553	6-200											
2045	14-95	3-8	607-00	15-887	4-140	6	93-37	108-33	3-8	4397-66	115-100	29-994											
2050	5-85	2-6	346-00	6-222	2-360	3	24-66	30-51	2-6	1805-64	32-470	12-316											
2063	7-38	9-5	86-00	5-540	-586	19	122-40	129-78	9-5	1511-72	97-983	10-301											
2109	14-13	16-1	96-80	10-600	-660	-	-	14-13	16-1	86-60	10-600	-660											
2161	28-67	2-1	780-00	10-875	5-300	1	22-93	51-60	2-1	1403-91	19-574	9-539											
2270	3-72	6-3	68-00	2-937	-464	5	19-99	23-70	6-3	433-83	18-738	2-960											
2409	7-67	7-1	98-00	3-072	-434	4	25-23	32-90	7-1	420-39	13-178	1-862											
3170	3-17	19-3	25-30	2-381	-123	-	-	3-17	19-3	25-30	2-381	-123											
3204	12-44	4-4	432-00	9-329	2-095	8	32-63	45-07	4-4	1565-15	33-799	7-590											
3228	5-50	1-5	550-00	4-124	2-667	-	-	5-50	1-5	550-00	4-124	2-667											
3271	10-00	4-1	380-00	7-500	1-843	2	18-53	28-53	4-1	1084-03	21-395	5-258											
3277	2-58	2-8	140-00	1-935	-679	33	224-77	227-34	2-8	12346-10	170-640	59-830											
3434	6-40	1-5	550-00	4-124	2-668	36	190-79	197-19	1-5	17521-10	133-567	82-203											
3470	50-77	1-4	1880-00	12-692	9-118	6	355-08	405-86	1-4	16909-04	114-154	72-888											
3653	50-77	1-5	1880-00	12-682	8-330	-	-	50-77	1-5	1880-00	12-682	8-330											
3760	37-15	5-2	18-00	-420	-080	7	50-68	67-83	5-2	42-56	.993	-189											
3911	17-96	10-8	280-90	13-470	1-244	4	25-00	42-86	10-8	671-95	32-222	2-976											
4060	18-24	1-3	1630-00	14-045	11-100	22	123-79	142-03	1-3	12692-40	109-365	86-433											
4076	22-12	3-1	773-00	16-591	5-267	7	72-04	94-16	3-1	3290-27	70-620	22-419											
4290	74-35	2-8	894-00	16-785	6-095	1	14-97	89-32	2-8	1073-99	20-164	7-322											
4291	12-85	1-5	477-00	4-825	3-250	-	-	12-85	1-5	477-00	4-825	3-250											
5102	15-73	4-4	30-70	-810	-185	-	-	15-73	4-4	30-70	-810	-185											
5038	13-32	2-9	530-00	10-344	3-593	12	120-63	133-94	2-9	5330-72	104-040	36-138											
6071	6-90	17-1	4-60	-600	-035	1	15-40	22-30	17-1	14-87	1-940	-113											
9603	23-05	14-4	200-00	19-590	1-363	1	1-52	24-56	14-4	213-16	20-879	1-453											
9604	8-81	3-2	302-00	6-565	2-061	16	44-78	53-69	3-2	1819-22	40-270	12-415											

BDO # 2 INSTALL STORM WINDOWS	C1 BUILDINGS			C1 BUILDING VARIABLES				C2 BUILDINGS			C1 AND C2 BUILDING TOTAL VARIABLES				
	BLDO #	BLDO AREA (1000 SQ FT)	PRYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLDO	BLDO AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PRYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO	
	1R2	4.91	20.7	49.60	7.008	.338		22.28	27.19	20.7	274.67	39.808	1.870		
	2R17	8.19	15.4	80.00	8.352	.544		621.13	629.32	15.4	6147.20	644.153	41.971		
	3R35	14.65	17.8	30.40	3.728	.210		26.72	41.38	17.8	65.86	10.527	.693		
	6R10	4.70	9.7	81.00	5.312	.550		-	4.70	9.7	81.00	5.312	.550		
	6R32	4.70	9.7	76.40	5.024	.520		1036.80	1041.50	9.7	16929.91	1113.300	115.200		
	1R16	3.11	15.4	13.00	1.312	.085		-	3.11	15.4	13.00	1.312	.085		
	5R8	4.70	9.7	85.10	5.600	.580		-	4.70	9.7	85.10	5.600	.580		
	5R31	4.70	9.7	80.80	5.310	.550		-	4.70	9.7	80.80	5.310	.550		
	5R32	4.70	14.5	80.80	7.968	.550		-	4.70	14.5	80.80	7.968	.550		
	10R8	14.65	14.7	137.00	13.760	.934		31.06	46.71	14.7	427.45	42.940	2.915		
	1C14	3.11	14.8	14.20	1.440	.087		99.46	102.57	14.8	468.32	47.524	3.201		
	1E4	4.72	9.7	71.50	4.704	.487		-	4.72	9.7	71.50	4.704	.487		
	1E6	4.72	15.4	44.00	4.704	.305		724.50	729.22	15.4	6787.81	734.716	47.671		
	1E20	7.67	9.6	120.00	7.800	.810		-	7.67	9.6	120.00	7.800	.810		
	2E4	2.28	14.2	28.00	2.696	.190		-	2.28	14.2	28.00	2.696	.190		
	3E34	3.78	18.4	27.50	3.465	.188		39.82	43.60	18.4	317.19	39.980	2.169		
	F2	9.83	14.7	61.40	6.166	.419		309.41	319.24	14.7	1994.03	200.290	13.606		
	1J5	2.00	14.9	17.00	1.728	.116		37.99	39.99	14.9	339.91	34.551	2.319		
	4301	20.69	15.4	79.50	8.320	.542		23.49	44.18	15.4	169.75	17.766	1.157		
	4431	4.72	15.4	53.00	5.536	.360		159.03	163.75	15.4	1938.71	192.053	12.489		
	1010	20.10	14.5	153.00	15.120	1.043		121.91	142.01	14.5	1080.97	106.825	7.400		
	1020	18.74	15.2	355.00	35.650	2.418		59.79	78.53	15.2	1487.62	149.391	10.132		
	1033	11.99	14.5	200.00	19.560	1.351		70.70	82.69	14.5	1379.31	134.920	9.317		
	1212	10.16	14.6	41.60	4.104	.284		207.71	217.87	14.5	882.06	87.971	6.088		
	1450	33.18	14.5	102.00	10.080	.695		3.98	37.16	14.5	114.23	11.289	.778		
	2001	30.75	9.7	150.00	9.608	.995		2.83	33.59	9.7	163.85	10.493	1.087		
	2050	5.85	9.6	60.50	3.984	.413		24.66	30.51	9.6	316.53	20.791	2.155		
	2109	14.13	13.7	563.00	51.760	3.765		-	14.13	13.7	563.00	51.760	3.765		
	2409	7.67	23.0	73.00	11.520	.500		25.23	32.90	23.0	313.13	49.417	2.145		
	3277	2.58	13.4	54.00	3.520	.262		224.77	227.34	13.4	4758.28	310.415	23.086		
	4290	74.35	9.7	1320.00	86.300	8.942		14.97	89.32	9.7	1585.77	103.674	10.742		
	5038	13.32	9.6	63.00	4.176	.433		120.63	133.94	9.6	633.50	42.002	4.355		
	5209	8.18	9.7	81.60	5.368	.555		-	8.18	9.7	81.60	5.368	.555		
	6071	6.90	9.7	86.00	5.658	.586		15.40	22.30	9.7	277.94	18.290	1.894		
	9630	285.38	13.1	1100.00	86.400	6.603		-	285.38	13.1	1100.00	86.400	6.603		
	9640	281.73	26.2	1100.00	172.800	6.603		300.92	582.84	26.2	2364.67	371.467	14.195		
	8641	45.68	9.6	153.00	10.080	1.045		43.43	89.11	9.6	298.46	19.663	2.038		
	8085	38.89	11.6	289.89	19.730	1.700		-	38.89	11.6	289.89	19.730	1.700		
	TOTAL	1022.11	14.3	7176.78	665.353	46.568		4368.62	5390.72	13.3	64050.82	4757.176	356.999	1.4	

DO - 3 WEATHER CALCULATIONS	C1 BUILDINGS				C2 BUILDINGS				C1 NO C2 BUILDING TOTAL VALUES					
	BLDG #	BLDG AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (KWH BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	* OF BLDG	BLDG AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (KWH BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	SAVE/INVEST RATIO
	1A2	4.91	2.9	28.80	.560	.196		22.20	27.19	2.9	159.48	31.010	1.085	
	2A17	8.19	2.8	44.00	.840	.302	322	621.13	623.32	2.8	3380.96	64.953	23.297	
	3A2	11.19	.7	71.60	.332	.488		11.71	22.89	.7	146.46	.678	.999	
	3A10	22.33	.2	110.00	.120	.730	-	-	22.33	.2	110.00	.120	.730	
	3A35	14.65	.8	74.00	.409	.505	2	26.72	41.36	.8	209.01	1.155	1.426	
	6A10	4.70	1.3	79.10	.724	.539	-	-	4.70	1.3	79.00	.724	.539	
	6A32	4.70	1.0	79.10	.564	.539	231	1036.80	1041.50	1.0	17528.22	124.980	119.400	
	7A11	3.87	.6	29.00	.129	.201	-	-	3.87	.6	29.00	.129	.201	
	1B16	3.11	3.3	24.00	.551	.167	-	-	3.11	3.3	24.00	.551	.167	
	5B8	4.70	1.2	79.10	.628	.539	-	-	4.70	1.2	79.11	.628	.539	
	5B31	4.70	1.1	79.10	.597	.539	-	-	4.70	1.1	79.11	.597	.539	
	5B32	4.70	1.1	79.10	.597	.539	-	-	4.70	1.1	79.11	.597	.539	
	10B8	14.65	2.7	80.40	1.488	.548	12	31.06	45.71	2.7	250.85	4.644	1.170	
	1C14	3.11	3.2	29.40	.649	.200	11	99.46	102.57	3.2	969.63	21.419	6.601	
	1E4	4.72	1.2	41.00	.344	.279	-	-	4.72	1.2	41.00	.344	.279	
	1E6	4.72	3.2	25.70	.557	.175	162	724.50	729.22	3.2	3970.54	86.651	27.676	
	1E20	7.67	1.9	66.00	.844	.450	-	-	7.67	1.9	66.00	.844	.450	
	2E4	2.28	4.3	16.00	.439	.103	-	-	2.28	4.3	16.00	.439	.103	
	3E34	3.78	1.1	49.70	.361	.340	8	39.82	43.60	1.1	573.25	4.294	4.124	
	F2	9.83	1.6	47.50	.513	.324	62	309.41	319.24	1.6	1542.61	16.858	10.522	
	1J5	2.00	2.4	20.30	.330	.139	6	37.99	39.99	2.4	405.89	6.598	2.779	
	4301	20.69	1.0	123.00	.805	.836	7	23.49	44.18	1.0	262.64	1.719	1.785	
	4431	4.72	5.8	13.00	.612	.090	31	159.03	163.75	5.8	451.01	21.231	3.122	
	1010	20.10	.4	174.00	.500	1.165	12	121.91	142.01	.4	1229.34	3.533	8.372	
	1033	11.98	1.5	113.00	1.150	.770	10	70.70	82.69	1.5	779.31	7.932	5.311	
	1212	10.16	1.2	112.00	.892	.762	22	207.71	217.87	1.2	2401.71	19.120	16.334	
	1263	34.73	2.9	72.80	1.445	.496	-	-	34.73	2.9	72.80	1.445	.496	
	2006	46.61	1.3	440.00	3.970	2.935	15	293.66	340.27	1.3	3212.16	34.468	26.940	
	2007	78.95	1.1	744.00	5.476	5.076	-	-	78.95	1.1	744.00	5.476	5.076	
	2020	107.23	1.1	1011.00	7.446	6.890	5	347.57	454.79	1.1	4287.91	31.582	29.224	
	2045	14.95	2.8	220.00	4.131	1.495	6	93.37	108.33	2.8	1594.15	29.929	10.831	
	2050	6.85	.7	66.00	.401	.564	3	24.66	30.51	.7	448.52	2.083	3.048	
	2063	7.38	5.2	70.00	2.465	.474	19	122.40	129.78	5.2	1230.87	43.330	8.332	
	2161	28.67	1.3	10.50	.089	.070	1	22.93	51.60	1.3	18.89	.160	.126	
	2163	17.59	7.4	2.50	.134	.018	-	-	17.59	7.4	2.50	.134	.018	
	2270	3.72	1.0	46.70	.310	.318	5	19.89	23.70	1.0	297.52	1.978	2.029	
	2409	7.67	4.2	45.00	.845	.305	4	25.23	32.90	4.2	193.02	3.825	1.308	
	3277	2.58	2.5	24.30	.300	.118	33	224.77	227.34	2.5	2141.22	26.466	10.397	
	4060	18.24	.8	172.00	.935	1.172	22	123.79	142.03	.8	1339.32	7.281	9.126	
	4076	22.12	.7	233.00	1.111	1.590	7	72.04	94.16	.7	991.83	4.729	6.768	
	4290	74.35	1.7	779.00	6.930	5.309	1	14.97	89.32	1.7	935.84	10.728	6.378	
	4291	12.85	3.3	70.60	1.601	.480	-	-	12.85	3.3	70.60	1.601	.480	
	5102	15.73	4.4	151.00	4.020	.910	-	-	15.73	4.4	151.00	4.020	.910	
	5038	13.32	1.5	140.00	1.491	.951	12	120.63	133.94	1.5	1407.77	14.996	9.565	
	6137	8.56	1.5	80.70	.805	.550	63	277.60	286.17	1.5	2687.89	26.905	18.382	
	6208	8.18	1.1	6.70	.045	.040	-	-	8.18	1.1	6.70	.045	.040	
	9500	52.05	.1	700.00	.300	3.000	-	-	52.05	.1	700.00	.300	3.000	
	9503	23.05	.08	220.00	.059	1.370	1	1.52	234.41	.08	234.41	.063	1.460	
	9630	286.38	.1	1700.00	1.500	10.146	-	-	286.38	.1	1700.00	1.500	10.146	
	9641	46.68	5.9	2.80	.117	.020	5	43.43	89.11	5.9	5.46	.228	.039	
	TOTAL	1147.61	1.1	8715.50	63.461	55.862	1127	5372.28	5619.86	1.7	59346.72	674.511	402.108	10.9

BDO # 4 FACILITY FACILITY	C1 BUILDINGS				C2 BUILDINGS				C1 NO C2 BUILDING TOTAL VARIABLES					
	BDO #	BLOO AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLOO	BLOO AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO
	382	11.18	7.6	2.20	-114	-016	1	11.71	22.89	7.6	4.50	-233	-031	
	1088	14.65	7.9	22.30	1.200	-192	12	31.06	45.71	7.9	69.57	3.745	-474	
	1E4	4.72	5.2	42.90	1.512	-292	-	-	4.72	5.2	42.90	1.512	-292	
	1263	34.73	5.0	515.00	17.400	3.500	-	-	34.73	5.0	515.00	17.400	3.500	
	2045	14.96	6.8	3.50	-162	-024	6	93.37	108.33	6.9	25.36	1.174	-170	
	2050	5.65	5.1	44.00	1.530	-300	3	24.66	30.51	5.1	229.47	7.984	1.566	
	2063	7.38	5.1	9.20	-324	-063	19	122.40	129.78	5.1	161.78	5.695	1.107	
	2161	28.67	6.9	168.00	7.926	1.145	1	22.93	51.60	6.9	302.36	14.266	2.060	
	3063	42.09	8.0	640.00	22.560	2.835	2	24.20	66.29	8.0	1007.97	39.531	4.955	
	3041	20.97	8.2	110.70	4.000	-490	-	-	20.97	8.2	110.70	4.000	-490	
	3170	3.17	11.0	10.30	-552	-050	-	-	3.17	11.0	10.30	-552	-050	
	3271	10.00	7.2	230.00	6.040	1.116	2	18.53	28.53	7.2	656.18	22.936	3.183	
	3277	2.58	7.1	20.10	-685	-097	33	224.77	227.34	7.1	1771.14	61.269	8.547	
	3750	37.15	12.9	6.00	-335	-026	7	50.68	87.83	12.9	14.18	-792	-061	
	3911	17.96	8.0	31.80	1.122	-141	4	25.00	42.96	8.0	76.06	2.684	-337	
	4060	18.24	5.2	240.00	8.400	1.625	22	123.79	142.03	5.2	1866.82	65.409	12.650	
	4076	22.12	11.0	60.70	4.536	-414	7	72.04	94.16	11.0	258.39	19.307	1.762	
	5102	15.73	8.8	9.90	-528	-050	-	-	15.73	8.8	9.90	-528	-050	
	5038	13.32	5.1	23.00	-810	-158	12	120.63	133.94	5.1	231.28	8.147	1.589	
	5209	8.18	5.2	69.00	2.430	-470	-	-	8.18	5.2	69.00	2.430	-470	
	6071	6.80	4.9	41.80	1.406	-285	1	15.40	22.30	4.9	135.09	4.545	-921	
	6580	257.74	4.2	82.1	2.340	-560	-	-	257.74	4.2	82.10	2.340	-560	
	TOTAL	598.29	6.4	2382.50	87.922	13.818	132	981.17	1579.44	6.4	7652.06	286.488	44.835	2.8

BDO # 9 COMM CONTROLS	C1 BUILDINGS				C2 BUILDINGS				C1 NO C2 BUILDING TOTAL VARIABLES					
	BDO #	BLOO AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLOO	BLOO AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO
	182	4.91	94.0	-29	-250	-003	6	22.28	27.19	94.0	1.60	1.384	-016	
	2817	8.19	94.0	-29	-250	-003	322	621.13	629.32	94.0	22.28	19.210	-230	
	382	11.19	94.0	-29	-250	-003	1	11.71	22.89	94.0	-59	-511	-006	
	3810	22.33	94.0	-29	-250	-003	-	-	22.33	94.0	-29	-250	-003	
	7811	3.87	94.0	-29	-250	-003	-	-	3.87	94.0	-29	-250	-003	
	5832	4.70	94.0	-29	-250	-003	-	-	4.70	94.0	-29	-250	-003	
	1088	14.65	195.0	-29	-250	-001	12	31.06	45.71	195.0	-91	-780	-003	
	1C14	3.11	94.0	-29	-250	-003	11	99.46	102.57	94.0	9.56	8.251	-098	
	1E4	4.72	94.0	-29	-250	-003	-	-	4.72	94.0	-29	-250	-003	
	1E6	4.72	94.0	-29	-250	-003	162	724.50	729.22	94.0	44.80	38.623	-463	
	1E20	7.67	94.0	-29	-250	-003	-	-	7.67	94.0	-29	-250	-003	
	2E4	2.28	94.0	-29	-250	-003	-	-	2.28	94.0	-29	-250	-003	
	F2	9.83	94.0	-29	-250	-003	62	309.41	319.24	94.0	9.42	8.119	-087	
	4431	4.72	94.0	-29	-250	-003	31	159.03	163.75	94.0	10.06	8.673	-104	
	2109	14.13	195.0	-29	-260	-001	-	-	14.13	195.0	-29	-250	-001	
	2161	28.67	94.0	-29	-250	-003	1	22.93	51.60	94.0	-72	-624	-007	
	2270	3.72	195.0	-29	-250	-001	5	19.99	23.70	195.0	1.85	1.595	-006	
	3236	6.63	195.0	-29	-250	-001	3	16.42	25.05	195.0	-84	-726	-003	
	3271	10.00	195.0	-29	-250	-001	2	18.53	28.53	195.0	-83	-713	-003	
	4280	74.35	94.0	-29	-250	-003	1	14.97	88.32	94.0	-35	-300	-004	
	9630	285.38	195.0	-29	-250	-001	-	-	285.38	195.0	-29	-250	-001	
	TOTAL	531.77	103.0	6.08	5.250	-051	619	2071.42	2603.17	86.3	106.13	81.509	1.060	

■ PAYBACK BEYOND ACCEPTABLE RANGE. S. I. R. NOT CALCULATED.

ECO • II REDUCE LEVEL	C1 BUILDINGS			C1 BUILDING VARIABLES					C2 BUILDINGS			C1 AND C2 BUILDING TOTAL VARIABLES				
	BLDG #	BLDG AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLDG	BLDG AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO		
	2163	17.59	1.4	65.80	-550	-405	-	-	17.59	1.4	65.80	-550	-405			
	2272	36.26	-2	740.00	-160	-955	-	-	36.26	-2	740.00	-160	-955			
	3114	33.46	3.1	54.20	-360	-117	-	-	33.46	3.1	54.20	-360	-117			
	3277	2.58	-2	163.00	-060	-340	33	224.77	227.34	-2	14362.95	6.291	29.983			
	3750	37.15	7.2	34.80	-540	-075	7	50.68	87.83	7.2	82.87	1.277	-177			
	9504	8.91	3.6	60.00	-702	-194	18	44.78	53.69	3.6	301.29	4.229	1.169			
	TOTAL	135.95	1.1	1107.80	2.372	2.086	58	.23	456.17	0.36	15507.11	11.867	32.806	39.4		

200 = 12 REPLACE INCAND- LIGHTS	C1 BUILDINGS				C2 BUILDINGS				C1 AND C2 BUILDING TOTAL VARIABLES					
	BLDG #	BLDG AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLDG	BLDG AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO
	3A2	11.19	3.4	109.00	-670	-200	1	11.71	22.89	3.4	222.97	1-371	-409	
	3A10	22.33	6.1	42.00	1-308	-211		-	22.33	6.1	42.00	1-330	-211	
	3A35	14.65	2.8	957.00	7-255	2-550	2	26.72	41.38	2.8	2703.11	20-486	7-200	
	6A10	4.70	3.7	30.70	-330	-088	-	-	4.70	3.7	30.70	-330	-088	
	6A32	4.70	3.0	18.80	-150	-050	231	1036.80	1041.50	3.0	4188.16	33-239	11-079	
	5B8	4.70	3.9	30.70	-330	-085	-	-	4.70	3.9	30.70	-330	-085	
	5B31	4.70	5.1	12.00	-180	-035	-	-	4.70	5.1	12.00	-180	-035	
	5B32	4.70	7.5	11.80	-270	-036	-	-	4.70	7.5	11.80	-270	-036	
	10B6	14.65	3.6	31.90	-275	-077	12	31.06	45.71	3.6	19.53	-868	-240	
	1C14	3.11	2.9	22.10	-170	-053	11	99.46	102.57	2.9	728.87	5-610	1-947	
	1E4	4.72	6.1	8.60	-110	-018	-	-	4.72	6.1	8.67	-110	-018	
	1E20	7.67	4.7	63.00	1-030	-218	-	-	7.67	4.7	63.00	1-030	-218	
	2E4	2.28	6.7	2.30	-040	-006	-	-	2.28	6.7	2.30	-040	-006	
	3E34	3.78	2.8	70.80	-540	-193	8	39.82	43.60	2.8	816.63	6-231	2-227	
	4301	20.69	4.6	20.50	-280	-061	7	23.49	44.18	4.6	43.77	-588	-130	
	4431	4.72	7.2	12.50	-280	-039	31	159.03	163.75	7.2	433.66	8-714	1-353	
	1450	33.18	2.4	253.30	2-595	1-071	2	3.98	37.16	2.4	263.66	2-906	1-199	
	2022	37.99	5.0	61.30	1-040	-210	-	-	37.99	5.0	61.30	1-040	-210	
	2045	14.95	3.6	34.00	-235	-065	6	93.37	108.33	3.6	246.36	1-703	-471	
	2109	14.13	3.3	50.30	-440	-135	-	-	14.13	3.3	50.30	-440	-135	
	2161	26.67	2.3	250.00	1-065	-473	1	22.93	51.60	2.3	449.84	1-917	-851	
	2163	17.59	4.3	75.00	-670	-155	-	-	17.59	4.3	75.00	-670	-155	
	2270	3.72	4.1	1.90	-070	-017	5	19.99	23.70	4.1	12.10	-447	-108	
	2409	7.67	8.1	6.80	-410	-045	4	25.23	32.90	8.1	29.17	1-769	-193	
	3119	42.85	3.5	18.90	-180	-051	-	-	42.85	3.5	18.90	-180	-051	
	3114	33.46	3.5	18.90	-180	-051	-	-	33.46	3.5	18.90	-180	-051	
	3161	33.46	3.5	18.90	-180	-051	52	1627.20	1660.70	3.5	938.05	8-284	2-531	
	3204	12.44	5.3	61.90	-810	-152	8	32.63	45.07	5.3	224.26	2-935	-551	
	3238	8.63	3.1	31.40	-240	-077	3	16.42	25.05	3.1	91.14	-697	-224	
	3271	10.00	3.8	15.80	-160	-042	2	18.53	28.53	3.8	45.07	-456	-120	
	3277	2.58	6.5	12.70	-255	-039	33	224.77	227.34	6.5	1119.08	22-487	3-439	
	3470	50.77	3.3	50.30	-440	-135	6	355.06	405.85	3.3	402.09	3-957	1-214	
	3653	50.77	3.3	50.30	-440	-135	-	-	50.77	3.3	50.30	-440	-135	
	3750	37.15	4.1	433.70	4-055	-991	7	50.68	87.83	4.1	1025.35	9-588	2-343	
	4060	18.24	3.7	355.00	2-680	-725	22	123.79	142.03	3.7	2764.29	20-868	5-645	
	4076	22.12	4.8	45.00	-600	-125	7	72.04	94.16	4.8	191.56	2-644	-532	
	4290	74.35	2.3	171.60	1-175	-510	1	14.97	89.32	2.3	206.03	1-412	-613	
	5038	13.32	2.6	67.00	-465	-176	12	120.63	133.94	2.6	673.72	4-677	1-770	
	5137	8.56	3.5	18.90	-180	-051	83	277.60	286.17	3.5	631.85	6-016	1-705	
	5208	8.18	5.2	6.40	-200	-038	-	-	8.18	5.2	6.40	-200	-038	
	6071	6.90	2.9	11.40	-070	-024	1	15.40	22.30	2.9	36.84	-226	-078	
	9503	23.05	9.2	14.00	-330	-036	1	1.52	24.56	9.2	14.92	-352	-036	
	9504	8.91	3.0	27.00	-180	-060	18	44.78	53.69	3.0	162.69	1-085	-361	
	9641	45.68	5.2	863.70	5-775	1-115	5	43.43	89.11	5.2	1294.70	11-266	2-175	
	9660	207.52	4.6	65.50	-740	-162	2	42.68	250.21	4.6	76.98	-892	-195	
	9665	250.91	56.70	279.00	8-050	-142	27	79.96	330.87	56.7	367.91	10-615	-187	
	9999	6.09	4.4	11.60	-180	-041	-	-	6.09	4.4	11.60	-180	-041	
	9095	38.89	2.3	781.00	6-685	2-812	-	-	38.89	2.3	781.00	6-685	2-812	
	TOTAL	1306.02	3.8	5406.20	63-893	13-938	611	4755.70	6061.76	3.8	21721.24	209-841	55-653	3.8

Bldg #	C1 BUILDING				C2 BUILDING				C1 AND C2 BUILDING TOTAL VARIABLES					
	Bldg #	Bldg Area (1000 sq ft)	Payback (Yr)	Energy Save (1000 Btu/yr)	Const Cost (\$1000)	Ecost Save (\$1000/yr)	# of Bldg	Bldg Area (1000 sq ft)	Total Area (1000 sq ft)	Payback (Yr)	Energy Save (1000 Btu/yr)	Const Cost (\$1000)	Ecost Save (\$1000/yr)	Save/Invest Ratio
382	382	11.19	-08	562.0	-300	3.830	1	11.19	22.84	0.08	1149.61	-614	7.839	
3835	3835	14.65	-08	545.0	-300	3.710	2	26.72	41.38	-08	1539.39	-847	10.476	
1088	1088	14.55	-08	715.0	-300	4.875	12	31.06	45.71	-08	2230.89	-936	15.213	
1C14	1C14	3.11	-40	112.0	-300	-765	11	99.46	102.57	-40	3693.93	9.901	25.230	
1E20	1E20	7.67	-50	86.8	-300	-591	-	-	7.67	-50	86.8	-300	-591	
F2	F2	9.93	-30	499.0	-850	3.400	62	309.41	319.24	-30	18205.57	27.602	110.406	
4301	4301	20.68	-08	1159.0	-300	7.900	7	23.49	44.18	-08	2474.95	-641	16.869	
1010	1010	20.10	-10	405.0	-300	2.763	12	121.91	142.01	-10	2661.39	2.120	19.521	
1033	1033	11.99	-08	760.0	-300	5.170	10	70.70	82.69	-08	5241.40	2.069	35.661	
1212	1212	10.16	-08	580.0	-300	3.951	22	207.71	217.87	-08	12437.50	6.431	84.691	
1263	1263	34.73	-08	1481.0	-300	10.090	-	-	34.73	-08	1481.00	-300	10.090	
2001	2001	30.75	-36	369.0	-900	2.515	1	2.83	33.59	-36	403.08	-993	2.747	
2006	2006	46.81	-08	715.0	-300	4.870	15	293.66	340.27	-08	5219.76	2.190	43.118	
2007	2007	76.96	-08	652.0	-300	7.566	-	-	78.95	-08	652.0	-300	7.566	
2022	2022	37.99	-08	637.0	-300	4.340	-	-	37.99	-08	637.0	-300	4.340	
2063	2063	7.36	-20	242.0	-300	1.646	19	122.40	129.78	-20	4255.65	5.275	28.934	
2161	2161	28.67	-10	364.0	-300	2.480	1	22.93	51.60	-10	655.12	-540	4.464	
2270	2270	3.72	-30	152.0	-300	1.035	5	19.99	23.70	-30	969.39	1.914	6.603	
2272	2272	36.26	-40	106.2	-300	-725	-	-	36.26	-40	106.20	-300	-725	
3063	3063	42.09	-08	1280.0	-300	5.658	2	24.20	66.29	-30	2015.94	3.472	11.154	
3041	3041	20.97	1.3	507.0	3.000	2.243	-	-	20.97	1.3	507.0	3.000	2.243	
3119	3119	42.85	-085	721.0	-300	3.497	-	-	42.85	-08	721.0	-300	3.497	
3161	3161	33.46	-085	721.0	-300	3.497	52	1627.20	1660.70	-08	36784.96	15.189	173.564	
3204	3204	12.44	-08	721.0	-300	3.497	8	32.63	45.07	-08	2612.17	1.067	12.669	
3271	3271	10.00	-35	176.0	-300	-854	2	18.53	28.53	-35	502.12	-856	2.436	
3277	3277	2.58	-66	155.0	-500	-752	33	224.77	227.34	-70	13658.02	44.093	66.263	
3811	3811	17.96	-086	793.0	-300	3.511	4	25.00	42.86	-08	1896.84	-718	8.399	
5036	5036	13.32	0.10	393.0	-300	2.560	12	120.63	133.94	-10	3951.83	3.017	26.955	
5137	5137	8.56	-10	331.0	-300	2.256	83	277.60	286.17	-10	11065.69	10.027	75.402	
5209	5209	8.18	1.5	370.0	2.400	1.625	-	-	8.18	1.5	370.00	2.400	1.625	
9500	9500	52.05	0.3	241.6	-300	1.070	-	-	52.05	-30	241.60	-300	1.070	
9603	9603	23.05	-08	500.0	-300	3.410	1	1.52	24.56	-08	532.75	-320	3.634	
9641	9641	45.68	0.10	358.2	-300	2.441	5	43.43	89.11	-10	698.76	-565	4.762	
9660	9660	207.62	0.10	567.90	-300	2.515	2	42.68	250.21	-10	684.72	-362	3.032	
TOTAL	TOTAL	969.81	-14	17877.29	16.350	111.728	384	3802.17	4771.96	0.17	137543.03	149.289	831.789	67.3

Bldg #	C1 BUILDING				C2 BUILDING				C1 AND C2 BUILDING TOTAL VARIABLES					
	Bldg #	Bldg Area (1000 sq ft)	Payback (Yr)	Energy Save (1000 Btu/yr)	Const Cost (\$1000)	Ecost Save (\$1000/yr)	# of Bldg	Bldg Area (1000 sq ft)	Total Area (1000 sq ft)	Payback (Yr)	Energy Save (1000 Btu/yr)	Const Cost (\$1000)	Ecost Save (\$1000/yr)	Save/Invest Ratio
1088	1088	14.65	15.0	27.8	-540	-036	12	31.06	45.71	15.0	86.73	1.684	-112	
1E20	1E20	7.67	37.5	6.0	-300	-008	-	-	7.67	37.5	6.0	-300	-022	
2001	2001	30.75	13.6	17.0	-300	-022	1	2.83	33.59	13.6	18.57	-328	-024	
2020	2020	107.23	13.0	17.5	-300	-023	5	347.57	454.79	13.0	74.22	1.272	-098	
3063	3063	42.09	8.3	27.8	-300	-036	2	24.20	66.29	8.3	43.78	-472	-057	
3119	3119	42.85	3.3	70.0	-300	-091	-	-	42.85	3.3	70.0	-300	-091	
3161	3161	33.46	23.8	9.7	-300	-013	52	1627.20	1660.70	23.8	481.43	15.189	-645	
TOTAL	TOTAL	278.70	10.2	175.8	2.340	0.229	72	2032.66	2311.60	18.63	780.73	19.545	1.049	.75

BDO # 20 REGULATOR CONTROLS	C1 BUILDINGS		C1 BUILDING VARIABLES					C2 BUILDINGS					C1 AND C2 BUILDING TOTAL VARIABLES				
	BLOO #	BLOO AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	# OF BLOO	BLOO AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	SAVE/INVEST RATIO			
	1A2	4.91	3.4	61.0	1.400	-413	6	22.28	27.19	3.4	337.80	7.762	2.286				
	3A35	14.65	1.2	291.0	2.400	1.981	2	26.72	41.38	1.2	821.95	6.777	5.594				
	3063	42.09	9.6	424.0	18.000	1.875	2	24.20	66.29	9.6	667.79	28.349	2.953				
	3750	37.15	26.9	5.9	-700	-026	7	50.68	87.33	26.9	13.92	1.655	-.061				
	5038	13.32	5.4	198.0	7.300	1.351	12	120.63	133.94	5.4	1891.00	73.423	13.585				
	5209	6.18	3.7	98.7	2.500	-670	-	-	8.18	3.7	98.70	2.500	-.670				
	9503	23.05	10.3	142.0	10.00	-970	1	1.52	24.56	10.3	151.30	10.658	1.034				
	TOTAL	143.35	5.80	1220.6	42.300	7.286	30	246.03	388.87	5.0	4082.46	131.114	26.183	2.4			

BDO # 22 LOW UPRT SHOWER HEADS	C1 BUILDINGS				C2 BUILDINGS				C1 AND C2 BUILDING TOTAL VARIABLES					
	BLOO #	BLOO AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	# OF BLOO	BLOO AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	SAVE/INVEST RATIO
	1A24	8.00	0.4	46.5	-120	-335	29	202.61	210.61	0.4	1224.17	3.159	9.309	
	3A10													
	6A10	22.33	-08	484.1	-160	3.460	-	-	22.33	-08	484.1	-160	3.460	
	6A32	4.70	-20	100.8	-130	-720	-	-	4.70	-20	100.80	-130	-720	
	588	4.70	-20	100.8	-130	-720	231	1036.80	1041.50	-20	22336.85	28.807	159.549	
	5831	4.70	-20	100.8	-130	-720	-	-	4.70	-20	100.80	-130	-720	
	5832	4.70	-20	100.8	-130	-720	-	-	4.70	-20	100.80	-130	-720	
	1E4	4.72	-10	65.9	-070	-470	-	-	4.72	-10	65.91	-070	-470	
	1E20	7.67	-30	70.0	-150	-490	-	-	7.67	-30	70.0	-150	-490	
	1020	18.74	-80	55.8	-315	-400	3	59.79	78.53	-80	233.83	1.320	1.676	
	2006	46.61	-20	143.0	-200	1.045	15	293.66	340.27	-20	1043.95	1.880	11.814	
	2007	78.95	-10	590.8	-420	4.185	-	-	78.95	-10	590.8	-420	4.185	
	2020	107.23	-10	887.3	-650	6.227	5	347.57	454.79	-10	3763.27	2.757	26.412	
	3119	42.85	-08	573.7	-245	2.907	-	-	42.85	-08	573.7	-245	2.907	
	3114	33.46	-18	299.5	-280	1.537	-	-	33.46	-18	229.5	-280	1.537	
	3161	33.46	-12	317.5	-190	1.640	52	1627.20	1660.70	-12	15758.29	9.955	81.397	
	3470	50.77	-18	487.7	-425	2.365	6	355.08	405.85	-18	3898.62	3.397	18.905	
	3653	50.77	-25	372.9	-460	1.775	-	-	50.77	-25	372.9	-460	1.775	
	4292	10.49	-90	80.6	-490	-575	-	-	10.49	-90	80.6	-490	-575	
	TOTAL	539.55	0.15	4979.3	4.825	31.011	341	3922.71	4462.29	0.16	51129.69	54.070	327.341	108.5

BDO # 25 PREVENT AIR STRATIF.	C1 BUILDINGS				C2 BUILDINGS				C1 AND C2 BUILDING TOTAL VARIABLES					
	BLOO #	BLOO AREA (1000 SQ. FT.)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	# OF BLOO	BLOO AREA (1000 SQ. FT.)	TOTAL AREA (1000 SQ. FT.)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	SAVE/INVEST RATIO
	3A10	22.33	1.4	326.0	3.050	2.116	-	-	22.33	1.4	326.0	3.050	2.116	
	3A35	14.65	0.87	273.0	1.550	1.755	2	26.72	41.38	0.87	771.10	4.377	4.957	
	1B16	3.11	3.1	36.0	-620	-197	-	-	3.11	3.1	36.0	-620	-197	
	1C14	3.11	0.77	55.0	-310	-354	11	99.46	102.67	0.87	1813.93	10.231	11.675	
	3E34	3.78	1.0	63.5	-620	-390	8	39.82	43.60	1.6	732.433	7.151	4.498	
	F2	9.83	0.5	184.0	-610	1.210	62	309.41	319.24	0.5	5875.60	19.808	39.292	
	2022	37.99	0.5	483.0	1.860	3.165	-	-	37.99	0.5	483.0	1.860	3.165	
	3271	10.00	-92	208.0	-930	1.008	2	18.53	28.53	-87	593.42	2.875	3.067	
	9570	120.24	0.80	547.5	1.860	2.300	-	-	120.24	-80	547.5	1.860	2.300	
	9630	285.38	1.6	1530.0	24.800	15.360	-	-	285.38	1.6	1530.0	24.800	15.360	
	TOTAL	510.42	1.2	3705.00	36.210	27.865	85	493.94	1004.37	0.8	12807.993	76.632	86.627	13.8

BDO # 26 (W/STALL TITLER)	C1 BUILDINGS				C1 BUILDING VARIABLES				C2 BUILDINGS				C1 AND C2 BUILDING TOTAL VARIABLES			
	BLDD #	BLDD AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (HLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	# OF BLDD	BLDD AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (HLN BTU/YR)	CONST. COST (\$1000)	ECOST. SAVE (\$1000/YR)	SAVE/INVEST RATIO		
	2163	17.59	1-9	20-0	-250	.135	-	-	17.59	1-9	20-0	-250	-135			
	6038	13.32	3-0	10-7	-219	-.073	12	120.63	133.94	3-0	107.59	2.198	-.730			
	9630	285.36	7-1	28-00	-260	-.035	-	-	285.36	7-1	28-00	-250	-.035			
	TOTAL	316.29	2-95	58-70	.719	-.243	12	120.63	436.91	2-89	165.59	\$2,268	-.800	3.6		

[illegible]

BTO • 32 INSUL. CONGENS. LINES	C1 BUILDINGS				C2 BUILDINGS				C1 AND C2 BUILDING TOTAL VARIABLES					
	BLOO *	BLOO AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (HLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLOO	BLOO AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (HLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO
	3R35	14.85	0-6	24-00	0-100	0-170	2	262-72	41-39	0-6	67-79	-282	-480	
	TOTAL	14.85	0-6	24-00	0-100	0-170	2	262-72	41-39	0-6	67-79	-282	-480	20-7

ED - 42 DOMESTIC PM	C1 BUILDINGS		C1 BUILDING VARIABLES					C2 BUILDINGS		C1 AND C2 BUILDING TOTAL VARIABLES				
	BLDG #	BLDG AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (HLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLDG	BLDG AREA (1000 SQ FT)	PAYBACK (YR)	TOTAL AREA (1000 SQ FT)	ENERGY SAVE (HLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO
-	1A24	8.00	32.	4.6	1.36	-.042	29	202.62	32.	210.61	121.1	35.6	1.105	
	2A17	8.19	2.6	24.0	.62	-.238	322	621.13	2.6	629.32	1844.16	47.64	18.287	
	3A10	22.33	93.	35.7	19.8	-.210	-	-	93.	22.33	35.7	19.8	-.210	
	3A35	14.65	21.	24.4	3.1	-.151	2	26.72	21.	41.38	68.9	8.75	-.426	
	6A10	4.70	32.	4.6	1.36	-.042	-	-	32.	4.70	4.6	1.36	-.042	
	6A32	4.70	32.	4.6	1.36	-.042	231	1036.80	32.	1041.50	1019.34	301.37	9.307	
	7A11	3.87	2.6	24.0	.62	-.238	-	-	2.6	3.87	24.0	.62	-.238	
	5B8	4.70	32.	4.6	1.36	-.042	-	-	32.	4.70	4.6	1.36	-.042	
	5B31	4.70	32.	4.6	1.36	-.042	-	-	32.	4.70	4.6	1.36	-.042	
	5B32	4.70	32.	4.6	1.36	-.042	-	-	32.	4.70	4.6	1.36	-.042	
-	10B8	14.65	48.	8.9	2.1	-.044	12	31.06	48.	45.71	27.76	6.552	-.137	
	1E4	4.72	32.	4.6	1.36	-.042	-	-	32.	4.72	4.6	1.36	-.042	
	1E20	7.67	32.	4.6	1.36	-.042	-	-	32.	7.67	4.6	1.36	-.042	
	2E4	2.28	2.6	24.0	.62	-.238	-	-	2.6	2.28	24.0	.62	-.238	
	3E34	3.78	2.6	24.0	.62	-.238	8	39.82	2.6	43.80	276.82	7.151	2.745	
	4A31	4.72	2.6	24.0	.62	-.238	31	159.03	2.6	163.75	832.62	21.509	8.256	
	1010	20.10	11.	84.5	6.9	-.605	12	121.91	11.	142.01	597.00	48.75	4.274	
	1020	18.74	11.	84.5	6.9	-.605	3	59.79	11.	78.53	364.09	28.914	2.535	
	1450	33.18	11.	84.5	6.9	-.605	2	3.98	11.	37.16	94.64	7.727	-.677	
	2022	37.99	93.	35.7	19.8	-.210	-	-	93.	37.99	35.7	19.8	-.210	
-	2161	28.67	93.	35.7	19.8	-.210	1	22.93	93.	51.60	64.25	35.64	-.378	
	2272	36.26	21.	24.4	3.1	-.151	-	-	21.	36.26	24.4	3.1	-.151	
	2409	7.67	2.6	24.0	.62	-.238	4	25.23	2.6	32.90	102.95	2.659	1.020	
	3119	42.85	11.	84.5	6.9	-.605	-	-	11.	42.85	64.5	6.9	-.605	
	3114	33.46	11.	84.5	6.9	-.605	-	-	11.	33.46	84.5	6.9	-.605	
	3161	33.46	11.	84.5	6.9	-.605	52	1627.20	11.	1660.70	4193.93	342.46	30.027	
	3204	12.44	48.	8.9	2.1	-.044	8	32.63	48.	45.07	32.24	7.61	-.159	
	3277	2.58	2.6	24.0	.62	-.238	33	224.77	2.6	227.34	2114.79	64.63	20.971	
	3653	50.77	11.	84.5	6.9	-.605	-	-	11.	50.77	84.5	6.9	-.605	
	3470	50.77	11.	84.5	6.9	-.605	6	355.08	11.	405.85	675.48	55.16	4.836	
-	5137	8.56	2.6	24.0	.62	-.238	83	277.60	2.6	286.17	802.34	20.73	7.956	
	5209	8.18	21.	24.4	3.1	-.151	-	-	21.	8.18	24.4	3.1	-.151	

■ BUILDINGS STUDIED UNDER CONTRACT SCOPE MODIFICATION.

ED - 44 POOL COVERS	C1 BUILDINGS		C1 BUILDING VARIABLES					C2 BUILDINGS		C1 AND C2 BUILDING TOTAL VARIABLES				
	BLDG #	BLDG AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLDG	BLDG AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO
-	2161		4.85	303.0	10.000	2.065	-			4.85	303.0	10.00	2.065	
	3236		2.70	604.0	9.65	3.565	-			2.70	604.0	9.65	3.565	
	9883		1.27	1320.0	9.86	7.791	-			1.27	1320.0	9.86	7.791	
	TOTAL	NA	2.19	2227.0	29.510	13.421		NA	NA	2.19	2227.0	29.51	13.421	8.1

■ BUILDINGS STUDIED UNDER CONTRACT SCOPE MODIFICATION.

BDO # 46 ORIGINAL - PIPES	C1 BUILDINGS				C1 BUILDING VARIABLES				C2 BUILDINGS				C1 AND C2 BUILDING TOTAL VARIABLES			
	BDO #	BLOO AREA (1000 SQ. FT.)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLOO	BLOO AREA (1000 SQ. FT.)	TOTAL AREA (1000 SQ. FT.)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST. COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO		
	1824	8.00	0.7	36.01	-200	-250	29	202.61	210.61	0.7	948.00	5.265	6.581			
	2817	8.19	2.0	5.8	-080	-040	322	621.13	629.32	2.0	445.67	6.175	3.103			
	588	4.70	1.4	3.5	-035	-025	-	-	4.70	1.4	3.50	-035	-025			
	5831	4.70	0.7	14.0	-070	-100	-	-	4.70	0.7	14.02	-070	-100			
	5832	4.70	1.0	4.4	-030	-030	-	-	4.70	1.0	4.4	-030	-030			
	164	4.72	1.1	12.3	-095	-065	-	-	4.72	1.1	12.26	-095	-065			
	1620	7.67	0.8	36.0	-200	-250	-	-	7.67	0.8	36.0	-200	-250			
	254	2.28	1.0	4.7	-031	-031	-	-	2.28	1.0	4.7	-031	-031			
	4431	4.72	0.8	3.5	-020	-025	31	159.03	163.75	0.8	121.42	-694	-667			
	1010	20.10	1.0	9.3	-066	-065	12	121.91	142.01	1.0	65.70	-459	-459			
	1263	34.73	1.1	35.9	-280	-245	-	-	34.73	1.1	35.90	-280	-245			
	2001	30.75	1.1	4.7	-031	-027	1	2.83	33.59	1.1	5.13	-034	-029			
	2007	78.95	0.08	288.5	-121	1.866	-	-	78.95	0.08	288.5	-121	1.866			
	2020	107.23	0.4	11.7	-035	-080	5	347.57	454.79	0.4	49.62	-148	-333			
	2022	37.99	0.7	8.3	-040	-060	-	-	37.99	0.7	8.32	-040	-060			
	2046	14.95	0.7	12.1	-060	-080	6	93.37	108.33	0.7	87.67	-435	-580			
	2409	7.67	-11	131.4	-100	-895	4	25.23	32.90	-11	563.63	-429	3.839			
	3204	12.44	-07	481.8	-155	2.337	8	32.63	45.07	-07	1745.56	-582	8.466			
	3238	8.63	2.07	1.5	-015	-007	3	16.42	25.05	2.07	4.35	-044	-020			
	4291	12.85	0.4	35.0	-105	-240	-	-	12.85	0.4	35.04	-105	-240			
	5137	8.56	0.9	13.1	-080	-090	83	277.50	286.17	0.9	437.95	2.674	3.008			
	5209	8.18	0.4	98.1	-250	-670	-	-	8.18	0.4	98.1	-250	-670			
	8504	8.81	1.5	28.0	-190	-123	18	44.78	53.69	1.0	168.72	1.145	-741			
	9650	207.52	1.5	9.3	-060	-041	2	42.68	250.21	1.5	11.21	-072	-049			
	TOTAL	649.14	0.30	1288.91	2.348	7.762	524	1987.79	2636.96	0.61	5195.37	19.393	31.777	29.8		

BDO # 47 INSUL. DOWN FRANKS	C1 BUILDINGS				C2 BUILDINGS				C1 AND C2 BUILDING TOTAL VARIABLES					
	BLDO #	BLDO AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BLDO	BLDO AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO
	3A2	11.19	2.1	3.2	-.052	-.025	1	11.71	22.88	2.1	6.54	-.106	-.051	
	1E4	4.72	3.2	2.3	-.052	-.016	-	-	4.72	3.2	2.34	-.052	-.016	
	1E20	7.67	2.9	3.4	-.052	-.018	-	-	7.67	2.9	3.4	-.052	-.018	
	4431	4.72	7.4	1.0	-.052	-.007	31	169.03	163.75	7.4	34.69	1.804	-.243	
	1263	34.73	3.5	1.8	-.052	-.015	-	-	34.73	3.5	1.8	-.052	-.015	
	2001	30.75	3.9	4.7	-.104	-.027	1	2.83	33.59	3.9	5.13	-.114	-.029	
	2006	46.61	5.2	2.3	-.104	-.020	15	293.66	340.27	5.2	16.79	-.769	-.146	
	2020	107.23	1.8	4.3	-.052	-.029	5	347.57	454.79	1.8	18.23	-.221	-.123	
	2272	36.26	4.7	1.6	-.052	-.011	-	-	36.26	4.7	1.6	-.052	-.011	
	3238	8.63	9.7	1.1	-.052	-.005	3	16.42	25.05	9.7	3.19	-.151	-.015	
	4292	10.49	3.2	2.3	-.052	-.016	-	-	10.49	3.2	2.30	-.052	-.016	
	5038	13.32	3.5	2.0	-.052	-.015	12	120.63	133.94	3.5	20.11	-.523	-.151	
	5137	8.56	3.5	2.1	-.052	-.015	83	277.60	286.17	3.5	70.21	1.738	-.501	
	9503	23.05	7.4	1.0	-.052	-.004	1	1.52	24.56	7.4	1.07	-.055	-.004	
	9504	8.91	6.0	1.9	-.052	-.008	18	44.78	53.69	6.0	11.45	-.313	-.048	
	9640	261.73	8.6	1.3	-.052	-.006	7	300.92	562.84	8.6	2.79	-.112	-.013	
	9660	207.52	4.3	2.7	-.052	-.012	2	42.68	250.21	4.3	3.25	-.063	-.014	
	9666	250.91	4.3	2.7	-.052	-.012	27	79.36	330.87	4.3	3.56	-.068	-.016	
	TOTAL	1077.00	3.98	41.7	1.040	0.261	206	1689.31	2776.2	4.39	208.45	6.287	1.430	4.2

C1 BUILDINGS		C1 BUILDING VARIABLES						C2 BUILDINGS		C1 AND C2 BUILDING TOTAL VARIABLES					
BDO #	BDO AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	# OF BDO	BDO AREA (1000 SQ FT)	TOTAL AREA (1000 SQ FT)	PAYBACK (YR)	ENERGY SAVE (MLN BTU/YR)	CONST COST (\$1000)	ECOST SAVE (\$1000/YR)	SAVE/INVEST RATIO		
1R24	8.00	-9	21.3	-125	-145	29	202.61	210.61	-9	560.75	3.291	3.817			
2R17	8.19	1.0	14.0	-090	-090	322	621.13	629.32	1.0	1075.76	7.137	7.152			
6R10	4.70	-9	21.3	-125	-145	-	-	4.70	-9	21.3	-125	-145			
1B16	3.11	1.0	19.0	-125	-130	-	-	3.11	1.0	19.0	-125	-130			
5B8	4.70	-9	21.3	-130	-145	-	-	4.70	-9	21.3	-130	-145			
5B31	4.70	-9	21.3	-125	-145	-	-	4.70	-9	21.3	-125	-145			
1C14	3.11	-9	19.4	-125	-132	11	99.46	102.57	-9	639.82	4.125	4.356			
2E4	2.28	-9	35.6	-225	-240	-	-	2.28	-9	35.6	-225	-240			
3E34	3.78	-9	21.0	-130	-144	8	39.82	43.60	-9	242.2	1.500	1.662			
4301	20.69	1.0	51.7	-350	-350	7	23.49	44.18	1.0	110.39	-747	-747			
2272	36.26	1.3	87.1	-460	-595	-	-	36.26	1.3	87.10	-460	-595			
TOTAL	99.52	0.88	332.9	2.010	2.261	377	986.5	1086.03	0.94	2834.42	17.990	19.134	12.7		

2.5 SUMMARY OF OTHER ECO: The ECO which were not found to be applicable for further analysis are summarized as follows:

ECO NO.

7. Reduction of glass area - treated as insulated panels, ECO 4.
8. Replace kitchen light fixtures - included under ECO 12, Replace Incandescent Lighting.
10. Heating oil flow meters - do not save energy in themselves.
15. Electric radiant heat - see ECO 16
18. Economizer cycles - all air systems investigated have and are utilizing economizer cycles.
24. Reduce air flow - in air systems surveyed, excessive air flow was not encountered.
29. Chiller replacement - the only chillers encountered were those serving computer areas and are kept in good condition.
30. Replace absorption chiller - not applicable.
31. Insulate steam lines - found adequate in most buildings. DEH has active policy for steam pipe insulation.
35. Transformer over voltage - deleted from contract. Negotiated Scope P.5.
36. Transformer loading - deleted from contract. Same as ECO #35.
37. Revise or replace building HVAC controls - treated as ECO 17, Night Setback.
40. High efficiency pumps on a replacement basis - Pumps encountered were of small size (less than 5 HP) and not appropriate for change to higher efficiency.
43. Reduce street lights - deleted from contract. Scope p.5.
5. Vestibules - found applicable in eight buildings with simple paybacks ranging from 5 to 17 years. Vestibules are specific in their building application and their paybacks did not warrant extension into the general population list.

6. Loading dock seals - found to be applicable in three buildings with a range of payback of from 6 to 8-1/2 years. DEH has installed seals on nearly all of frequently used loading doors.
14. High efficiency motor replacement - motors of sufficient size and operating hours to warrant consideration occurred in four buildings with a simple payback ranging from 12 to 29 years (sufficient size is greater than 5 HP with significant hours of operation).
49. Laundry dryer heat recovery - applicable only to the main Post laundry (1401) with a simple payback of 11 years.

3.0 TRAINING AND EXPENDABLE EQUIPMENT RECOMMENDATIONS:

3.1 TRAINING:

3.2 TRAINING COURSES AND SEMINARS:

* CORPS OF ENGINEERS - under the Government Employees Training Act the Corps of Engineers have provided a number of courses that meet unique Corps training needs. Appropriate courses are:

- ELECTRICAL INSPECTION - #042/ECE-E, NO. T1MEIN
- ENERGY CONSERVATION IN EXISTING BUILDINGS - #055/2CF-U, NO. P3MECB
- ENVIRONMENTAL ENGINEERING WORKSHOP - #102/ECE-B, NO. P1MSEC
- GENERAL CONSTRUCTION INSPECTION - #054/ECC-Q, NO. T1MGIN
- MECHANICAL INSPECTION - #074/ECE, NO. T1MMIN
- REFRIGERATION & AIR CONDITIONING INSPECTION - #096/ECE-E, NO. T1MRACIN
- WATER SUPPLY AND WATER CONSERVATION PLANNING - #041/CWP-D, NO. P1MESIAWS

AUDIOVISUAL:

- TEST AND MAINTENANCE EQUIPMENT (For further information contact Industrial Training Corp.)
- PUMP DOWN, EVACUATION, AND CHARGING (For further information contact Industrial Training Corp.)

For further information on the above C.O.E. Courses, the address is: Division Engineer

U.S. Army Engineer Division, Huntsville
Attention: HNDTD-SB, Registrar
Post Office Box 1600
Huntsville, AL 35807

Phone: (205) 895-5032

OTHER APPLICABLE NON-GOVERNMENT TRAINING INCLUDES:

* WESCO - Courses in the latest advancements in Electromechanical and Solid State Control.
CONTACT: 2233 6th Ave. S. Seattle, WA 98134

* CENTER FOR PROFESSIONAL ADVANCEMENTS - Short course format for Scientists, Engineers and Technical Managers. Emphasis is placed on applied and practical aspects of science and engineering. (HVAC, Feedwater Heaters, etc.)
CONTACT: P.O. Box H, East Brunswick, NJ 08816-0257
PHONE: (201) 238-1600

* COLLEGE OF ENGINEERING, UNIVERSITY OF WISCONSIN, MADISON - Many courses offered in skill building, problem solving, technical update, career development, or whatever your continuing education needs may be. Videocassette courses are also available.
CONTACT: Department of Engineering, Professional Development, 432 North Lake St., Madison, WI 53791-9943
PHONE: 1-800-262-6243

- * ASD, INC. - Adjustable Frequency Motor Control (3 day seminar and workshop), Turbomachinery - pumps, fans and compressors (2 day seminar), Power Line Harmonics (1 day seminar and workshop).
CONTACT: 910 Sherwood Drive, Lake Bluff, IL 60044
PHONE: (312) 362-6640
- * TECHPRO - Intensive course on finding, fixing and preventing most problems.
CONTACT: 326 Hurricane Shoals Rd., Lawrenceville, GA 30245
PHONE: (404) 963-6076
- * ELECTRO TEST, INC. - Effective Electrical Preventive Maintenance and Testing.
CONTACT: 3470 Fostoria Way, P.O. Box 159, San Ramon, CA 94583
PHONE: (415) 866-8566 ext. 304
- * BIDDLE INSTRUMENT - Electrical Insulation Testing.
- * MULTI-AMP INSTITUTE - Protective Devices Maintenance.
- * INSTRUMENT SOCIETY OF AMERICA - Boiler Control for Energy Efficiency.
- * AICHE - Pump Technology.
- * MARSHALL MAINTENANCE - Centrifugal Pump Maintenance.
- * GMI ENGINEERING AND MANAGEMENT INSTITUTE - Industrial Energy Management.
- * INTERNATIONAL PROGRAMMABLE CONTROLLERS, INC. - Introduction to Programmable Controllers.
- * TEL-A-TRAIN, INC. - Programmable Controller Training Package.
- * GREEN RIVER COMMUNITY COLLEGE - Basic Hydraulics, Water/Wastewater Training, Lubricants, etc.
CONTACT: 12401 S.E. 320th St., Auburn, WA 98002
PHONE: (206) 833-9111
- * LOCTITE CORPORATION - Maintenance and Repair Seminar.
CONTACT: 705 North Mountain Rd., Newington, CT 06111
- * NATIONAL TECHNOLOGY TRANSFER, INC. - Hydraulic Systems.
CONTACT: P.O. Box 110397, Aurora, CO 80011
PHONE: (303) 360-0101
- * TACOMA COMMUNITY COLLEGE - Energy Management.
CONTACT: 5900 So. 12th St., Tacoma, WA 98465
PHONE: (206) 756-5000
- * HONEYWELL - Winter Changeover Training Workshop
 - Pneumatic Temperature Control
 - Burner/Boiler Start UpCONTACT: Building Services Division, Honeywell Plaza, Minneapolis, MN 55408
PHONE: (612) 870-5200

- * GEORGE WASHINGTON UNIVERSITY - Electrical Equipment Testing and Maintenance.
CONTACT: School of Engineering & Applied Science,
Washington, D.C. 20052 PHONE: (202) 676-6106
TOLL FREE: 1-800-424-9773 (in the USA)
- * UNIVERSITY OF WASHINGTON, COLLEGE OF ENGINEERING - Engineering Management Courses, Project Cost Control.
CONTACT: 353 Loew Hall, FH-18, Seattle, WA 98195
PHONE: (206) 543-5539
- * NORTH SEATTLE COMMUNITY COLLEGE - Heating, Air Conditioning and Refrigeration Technology.
- * AEE ENERGY SEMINARS - Energy Auditing for Buildings and Industry
- Waste Heat Recovery
CONTACT: 4025 Pleasantdale Rd., Suite 340, Atlanta, GA 30340
PHONE: (404) 447-6452
- * PACIFIC LUTHERAN UNIVERSITY - Professional Development Guide 1985
CONTACT: Tacoma, WA 98447 PHONE: (206) 535-7330

3.3 AUDIOVISUAL TRAINING:

- * DUPONT - Videotapes and self-study courses in various fields.
(Some examples: Forklift Truck Operator Training, Pipe-Fitting, Basic Rigging, Safety Training Programs, etc.)
CONTACT: Training Services, Barley Mill 19-1210, Wilmington, DE 19898 PHONE: (302) 992-3620
- * NUSTC - Power Principles Programs (Basics & Practice)
- Chemical Plant Operations Training Program
- Boiler Training
CONTACT: 910 Clopper Rd., Gaithersburg, MD 20878-1399
PHONE: 1-800-848-1717
- * NATIONAL EDUCATION TRAINING CORPORATION - Electrical Technology, Hydraulics, etc.
- * INDUSTRIAL TRAINING CORPORATION - Air Conditioning and Refrigeration Training Program.

3.4 REFERENCE MATERIALS:

- * PLANT ENGINEERING - Reference file reprints on controllers, software, electrical controls, flowmeters, etc.
- * AEE ENERGY BOOKS - Reference catalog to help improve Operational and Energy Efficiency. (Waste Heat Recovery, Photovoltaic Applications, Energy Analysis, Nomograms for Steam Generation, Boiler Operations Sourbooy, etc. Cogeneration and Energy Management videotape courses are also available).
CONTACT: 4025 Pleasantdale Rd., Suite 340, Atlanta, GA 30340

* PLANT ENGINEERING - Nine (9) volumes of a Plant Engineer's Proven Problem Solvers (Electrical, Fluid Power and Mechanical Power Transmission, Material Handling, Construction, Maintenance, Pollution Control, Plant Protection and Energy Management).

CONTACT: Reprint Department, 1301 So. Grove Ave., P.O. Box 1030, Barrington, IL 60010

* APPA - Resources in Facilities Management.

CONTACT: 1446 Duke St., Alexandria, VA 22314-3492

* L.H. BATES VOCATIONAL - TECHNICAL INSTITUTE - Catalog of classes 1983/1984/1985

CONTACT: 1101 So. Yakima, Tacoma, WA 98405

PHONE: (206) 597-7220

* FORT STEILACOOM COMMUNITY COLLEGE - Catalog 1984 - 1985

CONTACT: 9401 Farwest Drive SW, Tacoma, WA 98498-1999

PHONE: (206) 964-6500

3.5 EXPENDABLE EQUIPMENT: The following list of energy consuming or related repair/replacement parts with a potential life expectancy of 5 years or less (see negotiated Scope of Work for criteria) was observed at Fort Lewis during the building surveys. These parts could be replaced with more energy efficient equipment as a normal maintenance procedure.

1. Thermostats
2. Aquastats
3. Oil Burner Nozzles
4. Fan Belts
5. Fan and Motor Sheaves
6. Fluorescent Light Ballasts
7. Incandescent Light Bulbs
8. Fluorescent Light Bulbs
9. Steam Traps

ENERGY SAVING PRODUCT & INSTALLATION SPECIFICATIONS

1. Thermostats (room): Adjustable electronic over a 60 - 80 degree range (+/- 1 degree F) Mercury or Bimetallic Thermometer; Tamper proof screws; Removable adjustment nob, locking cover. Comply with Federal and Military Standards and Specification 15805-13.5.2 and 15805-13.5.3.
Manufacturers: Johnson Controls, Barber Coleman, Powers
2. Aquastats: Electronic immersion type with averaging bulb; snap action electric switch; manual surface setpoint adjustment.
Manufacturers: Johnson Controls, Powers, Honeywell
3. Oil Burner Nozzles: High efficiency turbulator type nozzle; circular spray pattern; integral filter/strainer. Comply with Corps of Engineers Guide Specification 15602.2-9.1.
Manufacturers: Monarch, Cleaver Brooks, Kiwanee

4. Fan Belts: Notched V-Belt type, match pitch of sheaves provided; belt shall not slip under full load start conditions; belt shall ride with at least 7/8" of belt radius below the wall of the sheave.
Manufacturers: Gates, Browning, Dayton
5. Fan and Motor Sheaves: Preventive Maintenance sheave replacements; remove adjustable sheaves and replace with fixed sheave. Provide the number of grooves as recommended by fan Manufacturer or as required to keep belts from slipping under full load start conditions.
Manufacturer: Gates, Browning, Dayton
- 6 & 7. Fluorescent light ballasts and bulbs: Comply with ANSI C82.1 and UL 935; UL and Certified Ballast Manufacturers (CBM) approved; for service without the use of starters. Ballasts shall be high power factor type and shall produce full light output with 430 milliampere circuits and 40 watt lamps. All ballasts shall be energy saving design that does not use more than 74 watts for bare lamp fixtures and 74 watts in enclosed fixtures for two standard 34 watt rapid start lamps with 277 volt ballasts, and 83 watts and 75 watts with 120 volt ballasts. Ballasts shall not contain any PCB. Comply with Federal Specification W-B-30A & AM-2, W-L-00116D.
Manufacturers: General Electric, Westinghouse, Jefferson, Universal or Advance mfr; rapid start circuit.
8. Incandescent Light Bulbs: Inside frosted, dual service 125 - 130 volt, krypton type or energy saving equivalent. Comply with Federal Specification W-L-101H.
Manufacturers: General Electric, Sylvania, Phillips, Westinghouse
9. Steam Traps: Energy saving float type with integral thermostatic air bypass. Provide traps for use at pressure of steam system being modified. Comply with Federal Specification W-W-T-696 for type, style and class as applicable.
Manufacturers: Sarco, Armstrong, Reliance